## REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-7 are pending in this application. Claims 1, 6, and 7 have been amended to provide clarifications thereto.

### Rejection Under 35 U.S.C. §102:

Claims 1-7 remain rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Matsumoto (U.S. Patent No. 5,043,922). Applicant respectfully traverses this rejection.

For a reference to anticipate a claim, each element must be found in the reference, either expressly or under principles of inherency. Each element of the claimed invention is not found in Matsumoto. For example, Matsumoto fails to disclose "generating the shadow volume from a plane object by determining a position of each vertex of a plurality of polygons composing the plane object, with regard to a direction perpendicular to a surface of the plane object in accordance with the Z value of each pixel written in the Z-buffer, the Z value of each pixel written in the Z-buffer being unchanged during shadow volume generation," as required both by independent claim 1 and its dependents, and by independent claim 7. Similarly, Matsumoto fails to disclose "generating the shadow volume from a plane object by determining a position of each vertex of a plurality of polygons composing the plane object with regard to a direction perpendicular to a surface of the plane object in accordance with the Z value of each pixel written in the Z-buffer, the Z value of each pixel written in the Z-buffer being unchanged during shadow volume generation," as required by claim 6.

The Final Office Action now identifies different sections of Matsumoto that allegedly anticipate the claimed invention. In particular, the Office Action first alleges that Fig. 20 of Matsumoto and the description at column 28, lines 28-41 disclose a plane object composed of a

plurality of polygons, wherein the direction perpendicular to each of the plane objects is determined, referring to this process as the identification of normal vectors. The Office Action further alleges that in column 2, lines 31-47, the shadow volume generation process also involves the determination of the Z-value of each pixel written in the Z-buffer, where a Z-value is the distance from the viewpoint to the object (referred to Matsumoto as the depth value).

However, Applicant respectfully notes that both of these sections refer to the Brotman and Badler algorithm, which Matsumoto itself describes as disadvantageous. Indeed, in prefacing the description of the algorithm cited to in the Office Action, Matsumoto states that "it is not efficient or fast to calculate the brightness value from the normal vector after completion of the expansion of the span data and the shadow finding . . ." (col. 13, lines 30-33). With respect to the description of the Brotman and Badler algorithm given at column 2, lines 31-47, Matsumoto concludes its description by identifying three distinct problems with the algorithm at column 4, line 39 to column 5, line 6. Similarly, the Background and Summary section of the instant invention identifies techniques like the Brotman and Badler algorithm as being disadvantageous because they require additional exception case handling.

The Office Action also points to a portion of the "Overview of the System" of Matsumoto provided at column 6, lines 54-69 as allegedly further disclosing the claimed invention. But this description is merely an overview of the teachings of Matsumoto. Although Matsumoto suggests writing the shadow casting object into the Z-buffer, it does so to determine which edges of an object volume are used for creating shadow polygons and to identify where exception cases arise. For example, Matsumoto discloses determining whether there is a shadow based on the parity of the number of intersections between the line of sight and the shadow polygons (col. 6, lines 19-24), and whether exceptions arise that complicate that determination

(col. 10, lines 8-61). In other words, an object is written in the Z-buffer by using the light source as a viewpoint (hidden-surface removal) just to determine to which part of which edge of an object light is cast. Accordingly, in Matsumoto, a depth value stored in the Z-buffer after writing the object in the Z-buffer by using the light source as a viewpoint (hidden-surface removal) has no significance. When as a result of writing the object in the Z-buffer by using the light source as a viewpoint (hidden-surface removal), edges which should be treated in a special manner are found, exception processing for creating a shadow polygon corresponding to the edges is required.

Even if these portions were to be considered applicable to the claimed invention, Applicant respectfully submits that Matsumoto discloses at column 2, lines 31-47, that "a Z-buffer (depth buffer) *is modified* to store information needed for shadow generation in addition to depth values" (emphasis added). This teaching is in direct contradiction with the claimed invention in that Matsumoto discloses *modifying* the Z-buffer. Moreover, Matsumoto discloses, as is shown in Fig. 27, that a shadow volume may be generated from an object silhouette polygon (OSP). But using an OSP in the manner set forth in Matsumoto is unrelated to the claimed invention.

Indeed, the specification of the instant invention identifies as disadvantageous these techniques of Matsumoto that require searching for, and appropriately handling, exception cases. In marked contrast to Matsumoto, the claimed invention requires determining a position of each vertex of a plurality of polygons composing the plane object, with regard to a direction perpendicular to a surface of the plane object in accordance with the Z value of each pixel written in the Z-buffer, the Z value of each pixel written in the Z-buffer being unchanged during shadow volume generation. This technique advantageously reduces the number of exception

cases that may arise. The advantages of using the Z-buffer in this way are particularly evident when compared to the techniques of Matsumoto which, as noted above, first modify, then use, its Z-buffer to detect where exception cases arise.

To make these differences yet more clear, the independent claims now explicitly require that "the Z value of each pixel written in the Z-buffer [is] unchanged during shadow volume generation." Matsumoto explicitly teaches away from the claimed invention, at least because it discloses (1) modifying the Z-buffer, and (2) using the Z-buffer to handle exception cases. As such, Applicant respectfully submits that Matsumoto fails to anticipate the claimed invention. Accordingly, Applicant respectfully requests that the rejection of claims 1-7 under 35 U.S.C. §102 be withdrawn.

## Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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